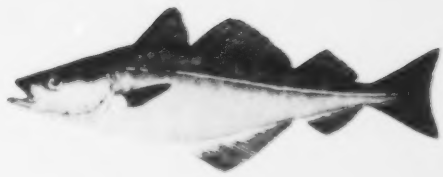
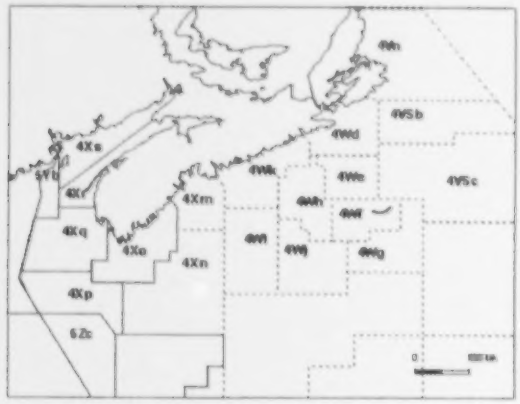
Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Maritimes Region

Canadian Science Advisory Secretariat
Science Advisory Report 2006/045

POLLOCK IN DIV. 4VWX AND 5Zc





The pollock management unit, showing unit areas comprising the Western Component (solid lines) and Eastern component (dashed lines).

Context

Pollock (Pollachius virens) in the western Atlantic range from southern Labrador to about Cape Hatteras. The main fishable concentrations occur on the Scotian Shelf, Georges Bank and in the Gulf of Maine.

Young pollock are closely associated with nearshore habitats, recruiting to the offshore populations at around age 2. Based on observations by fishermen and acoustic studies, pollock spend the least time on the bottom of all the cod-like fish. Pollock show strong schooling behaviour. Food of adult pollock include euphausiids and fish such as herring, sand lance and silver hake.

An evaluation of stock structure completed in 2003 indicated that the management unit is comprised of two parts: a slower-growing Eastern Component including Divs. 4V and 4W, as well as Unit Areas 4Xm and 4Xn, and a faster-growing Western Component including 4Xopqrs as well as Canadian portions of Subarea 5. Pollock are mature at ages 3 to 5 depending on the area.

A variety of fishing gear is used to fish pollock, primarily otter trawl and gillnets, but also handlines and longlines. Pollock are also landed as by-catch in the small-mesh silver hake and redfish fisheries.

A comprehensive review of the assessment framework, stock structure and biology was completed in 2004.

February 2007

Canada

SUMMARY

Western Component

- Since 2000, fishery removals have averaged 6,000t. The Western Component of the management unit contributed 92% of total landings in 2005.
- Estimates of age 4+ (considered spawning stock) biomass declined from about 66,000 t in 1984 to about 7,500 t in 2000. Biomass has been rebuilding since 2000, increasing steadily to about 30,000 t in 2006.
- The 2001 year-class is estimated to be the strongest since the 1980 year class, followed by the 1999 year class.
- Fishing mortality rates steadily increased from the early 1980s to above 1.0 by the early 1990s and remained high until the early 2000s. Subsequent reduced quotas and harvests have contributed to a decline in the fishing mortality rate on ages 6-9, which is now just below the F_{ref} of 0.2.
- The range of harvest strategies in the fishing year that are risk averse (25% risk of exceeding F_{ref}) to risk neutral (50% risk of exceeding F_{ref}) are about 4400 to 5300 t.

Eastern Component

- Landings from the Eastern Component traditionally come from the Tonnage Class (TC) 4+ sector, and have been following a declining trend. Since 1993, much of the Eastern Component was closed to cod-directed fishing, which further reduces pollock landings from that area.
- Research vessel (RV) summer survey biomass, while variable, has been declining since the late 1980s and is now at the third lowest level in the time series.
- Large scale directed pollock fisheries should not be considered until the Eastern Component rebuilds.

INTRODUCTION

Rationale for Assessment

Advice was requested by Fisheries and Aquaculture Management on the stock status of pollock to inform management of the 2007/2008 fishery. Specifically:

- Examine available data from various sources (e.g., surveys, commercial fishery and at-sea observer) for consistency with model predictions on population structure and industry observations, and recommend requirements for new information, monitoring or improved data collection.
- Update the advice using framework methodologies and the latest information from fisheries and research surveys.

The Fishery

Landings (000s t)*

Year	1970-1979 avg.	1980-1989 avg.	1990-1999 avg.	2000-2001 avg.	2002	2003	2004	2005	2006
TAC		46.9	24.2	10.0	10.0	10.0	10.0	6.5	4.5
EAST	7.8	21.2	7.7	0.8	0.5	0.2	0.4	0.7	
WEST	14.1	17.4	11.8	5.1	7.0	8.1	8.6	5.6	
TOTAL	21.9	38.6	19.5	6.0	7.5	8.3	9.0	6.3	

*Commencing in 2000, fishing year, landings and TAC refer to the period April 1st of the current year to March 31st of the following year.

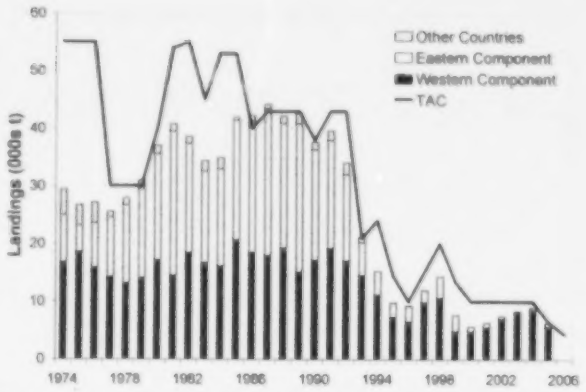


Figure 1. Landings and TACs for pollock in 4VWX5Zc, for the Eastern and Western components. Foreign landings are also included.*

For 2006, landings in the fishery from April 1 through November 3 are 2651 t. Peak landings in 1987 were 46,000 t; landings since 1999 have been less than 10,000 t (Figure 1).

The pollock fishery has had significant changes in both area fished and in dominant gear type. Landings from the Eastern Component traditionally come from the Tonnage Class (TC) 4+ sector, and have been following a declining trend. Since 1993, much of the Eastern Component has been closed to cod-directed fishing, which further reduces pollock landings from that area.

Since 2000, fishery removals have averaged 6,000t. The Western Component of the management unit contributed 92% of total landings in 2005. The contribution of larger trawlers to total landings (TC 4+) has been steadily declining since 1988 (Figure 2). The offshore sector is now using smaller vessels (TC 1-3, under the Temporary Vessel Replacement Program) to catch their allocation. Since the early 1980s, the small mobile gear component has accounted for most of the total landings. The percentage of total landings taken by gillnets has declined since 2000.

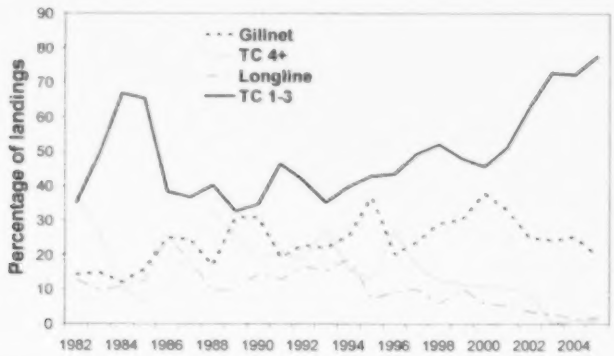


Figure 2. Percentage of landings by gear type for the Western Component, 1982-2005.

Landings from the Western component now come mostly from unit areas 4Xp, 4Xq and 5Zc, whereas as recently as 1997, landings were spread among different unit areas to a greater extent.

ASSESSMENT

Stock Trends and Current Status

Western Component

Mobile gear catch rates (CPUE; TC 1-3) have generally declined from a peak in 1984 to a low in 1999, then increased again in 2002 but have recently declined to the second lowest level in the time series (Figure 3). Catch rates in 2005 and 2006 were constrained by reduced quotas and changes in fishing practices and are not comparable to those earlier in the time series.

The **RV survey** biomass index while variable has been showing a general increasing trend since 2003 (Figure 3). **Other bottom trawl surveys** such as those conducted by the US National Marine Fisheries Service (NMFS) in the Gulf of Maine/Georges Bank region (NMFS Spring, NMFS Fall) and the ITQ survey (Bay of Fundy/western Scotian Shelf) indicate a general trend of increasing rather than decreasing biomass for pollock and support recent trends from the DFO survey (Figure 4).

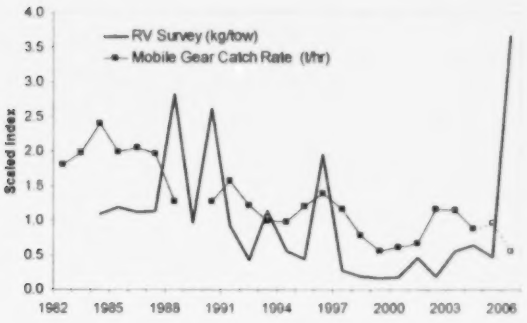


Figure 3. Mobile gear (TC 1-3) catch rates (kg/hr) and DFO summer survey biomass index (kg/tow).

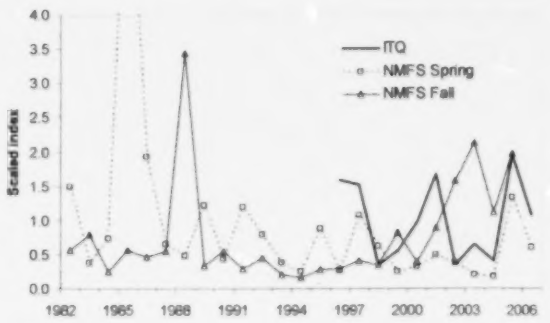


Figure 4. NMFS Spring, NMFS Fall and ITQ survey biomass indices (kg/tow).

Age-specific **indices of abundance** from the mobile gear sector of the fishery indicate a reduction in the abundance of older (7+) fish since 1996. In recent years, the 1999 year-class has been relatively strong, a trend which continues through to age 7 in 2006. The 2001 year class at age 5 was predominant in the series this year, notwithstanding problems with the time series for 2005 and 2006 (Figure 5).

Consistent with the CPUE indices, the DFO RV indices show that the 1999 year-class is strong. The 2002 year class at age 4 is now much stronger than indicated last year, and the 2001 and 2002 year classes at ages 6 and 5 in 2006, respectively, have reached record high levels (Figure 6). Record high indices at all ages should be interpreted with caution since indices for all year classes are inconsistent with values seen previously for these year classes.

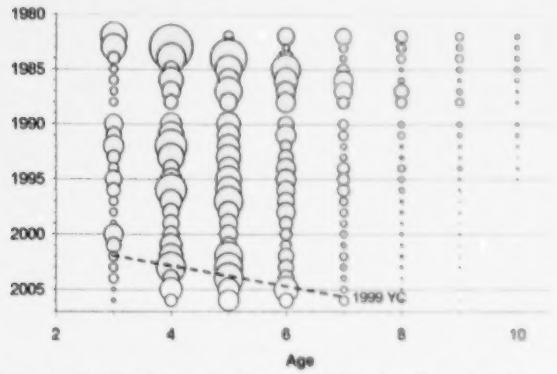


Figure 5. Mobile gear (TC 1-3) standardized catch rates at age. The index value is proportional to bubble area.

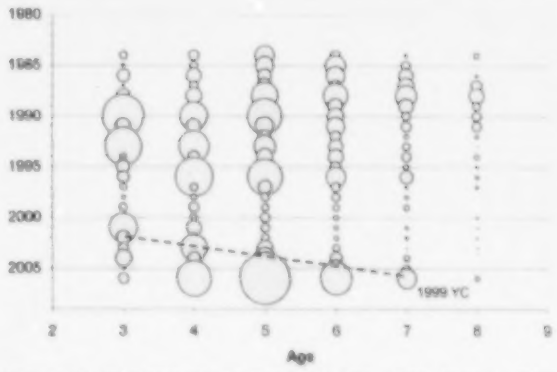


Figure 6. RV survey indices at age. The index value is proportional to bubble area.

The following results are based on an age-structured population model developed for the Western Component that incorporate indices of abundance from both the DFO summer research vessel survey (1984-2006) and standardized CPUE from the commercial fishery excluding the most recent two years (1982-2004).

Concerning **recruitment**, the 2001 year-class was estimated to be slightly higher than indicated last year and was the strongest at age 2 since 1980, followed by the 1999 year class (Figure 7). Initial indications for both the 2002 and 2003 year-classes are that they are of moderate strength.

Estimates of age 4+ (considered spawning stock) **biomass** declined from about 66,000 t in 1984 to about 7,500 t in 2000. Biomass has been rebuilding since 2000, increasing steadily to about 30,000 t in 2006 (Figure 7).

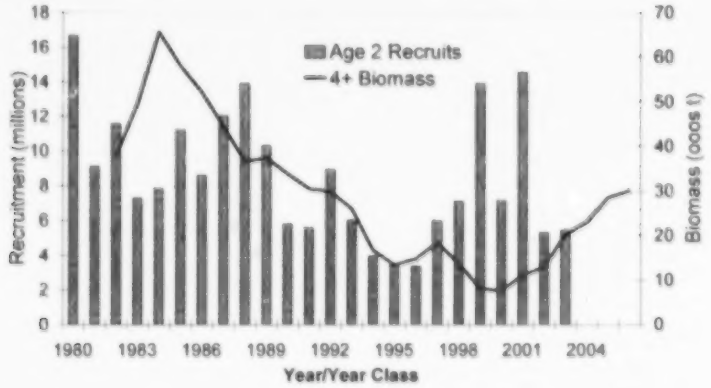


Figure 7. Trends in age 4+ biomass and age 2 recruitment of pollock for the Western Component.

The fishery **weights at age**, which are used as a proxy for population age 5+ weights at age, have been decreasing since about 1984 (Figure 8). RV survey weights at age (Figure 9) for these age groups do not show this same declining trend, indicating that the fishery weights may be influenced by changes in fishing patterns.

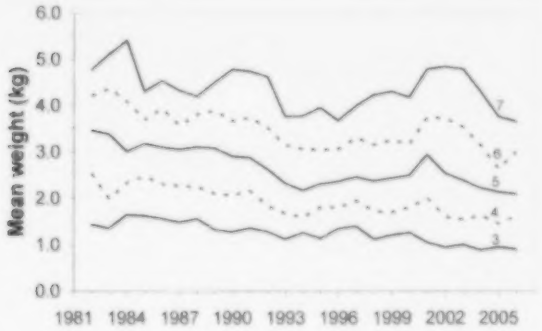


Figure 8. Commercial fishery weights at age for pollock in the Western Component.

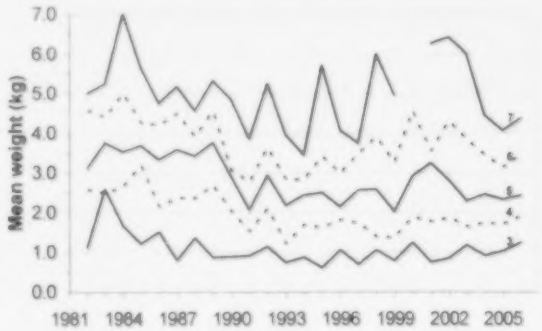


Figure 9. Research vessel survey weights age for pollock Western Component.

Fishing mortality rates steadily increased from the early 1980s to above 1.0 by the early 1990s and remained high until the early 2000s. Subsequent reduced quotas and harvests have contributed to a decline in the fishing mortality rate on ages 6-9, which is now just below the F_{ref} of 0.2 (Figure 10).

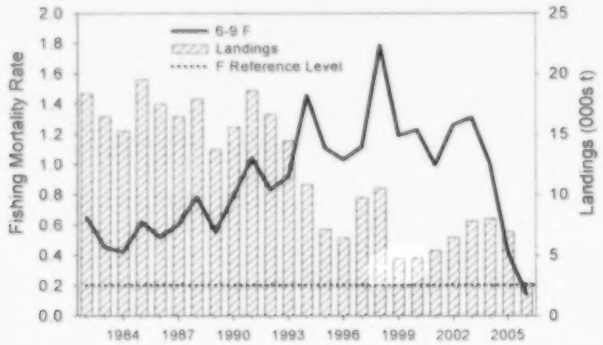


Figure 10. Trends in fishing mortality and landings of pollock for the Western Component.

Eastern Component

RV summer survey biomass, while variable, has been declining since the late 1980s and is now at the third lowest level in the time series (Figure 11).

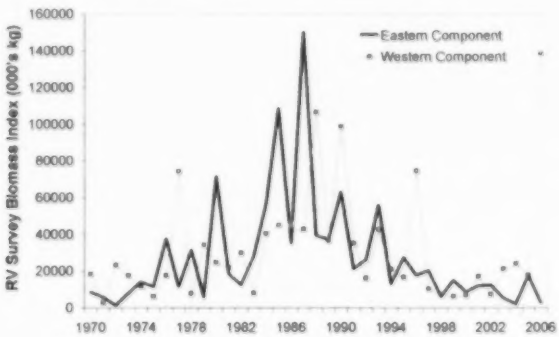


Figure 11. Trends in survey biomass indices for pollock from the Eastern and Western components.

Sources of Uncertainty

The results of the assessment depend, in part, on indices of abundance from the commercial fishery. Trends in catch rates for 2005 and 2006 appear to be confounded by changes in the fishery and management practices not associated with trends in abundance. Further examination of this time series is required to ensure its future utility. Fishermen have also indicated that there are very few "pollock directed" trips now compared to the past (i.e. where pollock represent > 50% of catch by weight) so that not many trips would qualify for inclusion in the catch rate series. Pollock, being a semi-pelagic, schooling species, are less well sampled by the summer RV survey than other gadids. This creates high variability in the RV abundance index from year to year. There is a concern over the lack of summer survey coverage on the Canadian portion of Georges Bank, an area that has become increasingly important to the fishery in recent years. If the proportion of the population on Georges Bank has increased in recent years, the survey would underestimate the recent biomass series. Survey weights-at-age do not display the recent decline seen in fishery weights. The selection of weights at age is influential in population biomass estimates and recent trends are impacting on calculation of biomass trends and reference points. Using survey weights at age could result in a greater proportional increase in biomass since 2000.

ADDITIONAL STAKEHOLDER PERSPECTIVES

The poor status of the pollock resource as described by the 2005 assessment is completely inconsistent with the perception of industry. During the 2006 Data Input Review eeting in Yarmouth, fishermen reported that all gear sectors were seeing abundant signs of pollock in 2006 throughout the stock area, despite the fact that they were trying to avoid this species due to the low quota. They expressed concern over the usefulness of the commercial catch rate series as an index of abundance. Under current quota restrictions, most fishermen are avoiding pollock as much as possible and recent catch rates (i.e. 2005 and 2006) would not be comparable to those observed earlier in the time series when quotas were not limiting. There have also been reports of discarding of pollock in 2006, but the extent of this problem is not known.

CONCLUSIONS AND ADVICE

For the Western Component, the range of harvest strategies in the fishing year that are risk averse (25% risk of exceeding F_{ref}) to risk neutral (50% risk of exceeding F_{ref}) are about 4400 t to 5300 t (Figure 11). Biomass risk analyses are not provided due to sensitivities to assumptions of recruiting year class strengths. This risk analyses does not incorporate the uncertainties as noted above and overstate the precision of the estimates of F_{ref} yield outcomes.

For the Eastern Component, large scale directed pollock fisheries should not be considered until the Eastern Component rebuilds. In 2006, limits were placed on the fishery that appear consistent with the advice to constrain removals from the Eastern Component.

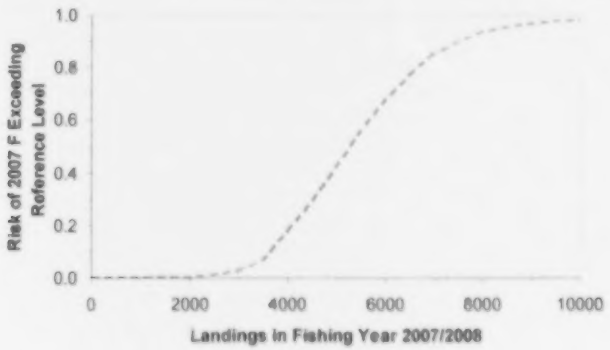


Figure 11: Probabilities of exceeding the F reference target with various harvesting scenarios, pollock in the Western Component.

SOURCES OF INFORMATION

DFO, 2006. Proceedings of the Maritime Provinces Regional Advisory Process on Scotia-Fundy Groundfish Stocks; 16-17 Nov. 2006. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2006/035.

DFO, 2004. Proceedings of the Pollock Framework Assessment: 1 May 2003, 16-18 June 2003 and 6-8 April 2004. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2004/030.

Stone H.H., P. Perley, and D. Clark. 2006. 2006 Assessment of Pollock in 4VWX and 5Zc. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/088.

FOR MORE INFORMATION

Contact: Heath Stone
St. Andrews Biological Station
531 Brandy Cove Road
St. Andrews, New Brunswick
E5B 2L9

Tel: (506) 529-5880
Fax: (506) 529-5862
E-Mail: stoneh@mar.dfo-mpo.gc.ca

This report is available from the:

Centre for Science Advice,
Maritimes Region and Gulf Region
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Phone number: 902-426-7070
Fax: 902-426-5435
e-mail address: XMARMRAP@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1480-4913 (Printed)
© Her Majesty the Queen in Right of Canada, 2006

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO, 2006. Pollock in Div. 4VWX and 5Zc. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/045.